

7.0 RECOMMENDATIONS

7.1 General

Based on the results of this remedy evaluation the MST proposes the following actions:

1. Assess areas which were not investigated during the RI that indicate potential impacts from the vadose zone to the ground water, including the S-X and scrubber pond areas where the largest ground water COC concentrations on site are identified, and other sites including the limestone settling ponds, MAP ponds and west calcine;
2. Install one shallow well on the site to assess impacts from the vanadium plant and install one shallow well to the south of the calcine cap and east or southeast of well KM-17 to assess the ground water characteristics in this area and identify potential off-site flow paths;
3. Assess the possible placement of a deep monitoring well downgradient of the industrial site;
4. Identify, characterize, and terminate the source of surface water that is currently infiltrating the Limestone Settling Pond area;
5. Sample high ground water where encountered in alluvium, such as within the scrubber pond basin;
6. Locate and assess the nature and extent and the potential impacts from process materials from the uninvestigated unlined Limestone Setting Ponds;
7. Develop a site-wide O&M Plan to develop a plan that promotes a reduction of infiltration onto pond basin areas that were identified during the 2008 inspection; and
8. Work with the USEPA and IDEQ on the preparation and implementation of required institutional controls.

Since the site inspection performed for the remedy evaluation in 2008, a number of corrective actions were completed at the landfill and calcine cap. The tap-rooted plants were addressed by spraying the landfill and calcine caps in the summers of 2009, 2010 and 2011, which was conveyed in the monthly reports to EPA. The landfill and calcine caps were also monitored in 2010 and 2011 for animal burrowing. No new animal burrowing was noted in 2010 or 2011 for these areas. The limestone settling pond area

that had standing water in 2008 has been dry for the past three years since the 2008 site inspection for the remedy evaluation report.

A work plan will be developed to address work to be conducted subsequent to the completion of the review of this report. Prior to conducting the characterization actions stated above, the MST will address measures that are intended to reduce the amount of infiltration through the S-X and scrubber pond basins including the assessment of run-on controls, providing additional site cover, performing site grading or locating and installing additional snow fence to reduce the potential volume of standing water and infiltration in these areas.

7.2 Recommendations For Site Facility

The following recommendations for investigation are arranged by site facility and are based on a review of the remedy and identification of potential data gaps in the remedy. The recommended investigation work described in this section will be conducted as specified in an EPA-approved work plan (or plans). The MST will develop the work plan(s), which will be reviewed by EPA and IDEQ, and approved by EPA, prior to conducting the investigation work. If other unknown or potentially significant source areas are identified, the MST will notify the EPA and will work with the EPA and IDEQ to evaluate the potential source for further study.

Covered S-X Pond – Potential impacts from the vadose zone to the ground water require assessment in this former pond basin because this basin was not investigated during the RI. The remedy evaluation identified this area as a likely uncontrolled source to ground water COC, and evidence of standing water suggests the occurrence of run-on to the S-X pond basin. Therefore, efforts to reduce the amount of standing water and run-on to the site should include the excavation of about 1000 feet of graded drainage ditch to the east of the S-X pond basin to intercept and re-direct rainfall and snowmelt runoff to the plant access road to the north and to the dirt road to the south of the S-X basin. Snow contributes about 40 percent of the total annual precipitation to the

site, and large snowdrifts are noted to occur on an annual basis in the area of the S-X pond. Therefore, approximately 1500 to 3000 feet (one or two rows depending on fence height) of snow fence should be placed to the south-southeast of the S-X pond basin to reduce the amount of snow on the S-X pond basin soil cover. This will also reduce the amount of snowdrift to the former limestone settling pond area and reduce the amount of snowdrift onto the west calcine area.

The site is adequately monitored by ground water wells. Therefore, the types of studies required to investigate the covered S-X pond site would include soil borings and geologic logging to characterize subsurface conditions, analyses of the selected samples retrieved from these borings, the installation of lysimeters and collection of soil pore water that would be representative of leachate potential. Limits of the S-X pond investigation would be within the previously identified basin and below high water boundaries of the former pond. Some of this investigated area will overprint on the calcine limits beneath this former pond area. Results of the investigation would be interpreted and assessed for potential for contribution to ground water, and assessed for the identification of remedial technologies to address the soils in the former pond.

Covered Scrubber Pond – Potential impacts from the vadose zone to the ground water require assessment in this former pond basin that was not investigated during the RI. The site is adequately monitored by ground water wells to the west. However, based on gradient analysis between wells KM-2 and KM-3, a southerly flow component cannot be ruled out entirely. The remedy evaluation identified this area as a probable contributor to ground water COC, and evidence of standing water suggests the occurrence of run-on to the cover from the plant area and from the calcine cap. Therefore, efforts to reduce the amount of standing water to the site should include improving the grades in the ditches to the infiltration basin locate to the south of the pond basin. During the winter months, significant snow accumulation is noted to occur in the scrubber pond basin due to the topographical depression formed by the facility. Snowfall contributes about 40 percent of the total annual precipitation to the site, therefore to reduce the potential run-on to the site from snowmelt, approximately 1300 to 2600 feet (one or two rows

depending on fence height) of snow fence should be placed to the south-southeast of the calcine cap and the scrubber pond basin to reduce the amount of snow onto the soil cover. This will also help to reduce the amount of snow that will drift and accumulate on the calcine cap and in the plant area west of the cap.

The types of studies required to investigate the covered scrubber pond would include soil borings and geologic logging to characterize subsurface conditions, analyses of the selected samples retrieved from these borings and in-situ testing, such as the installation of lysimeters and collection of soil pore water that would be representative of leachate potential from soils impacted by scrubber pond waters. If soil borings intercept the shallow aquifer in this area, water quality can be assessed in the alluvial aquifer, if present. Limits of the investigation of the former scrubber pond would be south of the calcine cap fence within the previously identified high water boundaries. Results of the investigation in the scrubber pond would be interpreted and assessed for potential contribution to ground water, and assessed for the identification of remedial technologies.

Vanadium Plant – The vanadium plant is a potential source of COC to ground water based on field inspection. However, this impact cannot be assessed because there are no historic ground water data to show that an impact to ground water exists, or to demonstrate that no impact exists. An evaluation of the vadose zone is not practical because the plant rests predominantly on bedrock. Therefore, a monitor well immediately west of the S-X processing part of the former plant appears to be the single alternative to addressing possible impacts. A snow fence should be placed to the south of the plant site to reduce the snowdrift onto the site. The snow fences proposed for the scrubber pond basin will reduce snow drift into this area.

Former Limestone Settling Ponds – The source of surface water that is currently infiltrating the limestone settling pond area should be identified, characterized and terminated. Since the time of the site inspection in 2008, this source has dried and has not reoccurred since 2008, leaving the cattail area dry for the past three-year period.

However, it is recommended that the source of this former water source be identified and terminated. This will require locating underground infrastructure or piping to permanently abandon the source of constant surface water overlying potentially uncontained sources. Potential impacts from the vadose zone to the ground water require assessment in this area because sediments from the covered ponds were not located in the field, characterized, or otherwise investigated during the RI. The site does not appear to have been included in RI/FS forward modeling since no characterization of the site was completed.

The site is adequately monitored by ground water wells KM-6 and KM-7. Therefore, the types of studies required to investigate this site would include soil borings and geologic logging to characterize subsurface conditions, analyses of the selected samples retrieved from these borings and the installation of lysimeters and collection of soil pore water that would be representative of leachate potential from one or more locations within and below source material. Limits of the investigation would be within the fenced area currently surrounding the covered ponds. Results should be interpreted and assessed for potential contribution to ground water, and assessed for the identification of remedial technologies, should significant contributions to ground water be implicated from the investigations.

MAP Ponds – The MAP product was reported to have been removed from these ponds prior to closure. Several soil borings should be placed in this area to characterize subsurface conditions and to confirm that MAP product is not remaining. Well KM-5 was affected by the MAP ponds as shown in the RI, but the recent flattening vanadium concentrations and seasonal changes in well KM-5 may result from on-going affects from the boiler blowdown/scrubber pond, or another source to the east of well KM-5, including the former vanadium plant facility.

Boiler Blowdown Scrubber Pond - Data from lysimeters L-4 and L-5 were input into the ground water model that was completed for the RI/FS. Well KM-5 is downgradient/lateral gradient from the boiler blowdown/scrubber pond. The recent

flattening of the vanadium concentration and seasonal changes in well KM-5 may result from on-going affects from the boiler blowdown/scrubber pond infiltration, or from another source to the east of well KM-5, including the former vanadium plant facility and the calcine. The types of studies required to investigate the boiler blowdown/scrubber pond includes a number soil borings located within the pond basin and in areas to the west and south of the covered pond to characterize subsurface conditions, logging, analyses of selected samples retrieved from these borings and installation of lysimeters and collection of soil pore water that would be representative of leachate potential. Results would be interpreted and assessed for potential contribution to ground water, and assessed for the identification of remedial technologies.

West Calcine - Soil pore-water data obtained from lysimeters L-1 and L-2 were input into the ground water model that was completed for the RI/FS to represent COC concentrations available from this solid source. The site is adequately monitored by ground water wells to the west and south of this source. Well KM-7 is completed in bedrock directly beneath this site. Seasonal changes in well KM-7 vanadium concentration may result from infiltration through the west calcine in the spring, affected by leaching from the on-going surface water source on the limestone settling ponds, or may result from another source to the east of well KM-7, including the former vanadium plant facility or the scrubber pond. Potential impacts from the S-X pond basin and limestone settling ponds occur within the west calcine limits. Therefore, the patterns of COC noted in the ground water in wells KM-6, KM-7, KM-8, KM-9, KM-12 and KM-13 result from the combined effects of these sources.

Consequently, to supplement the vadose investigations of the limestone settling ponds and the S-X pond basin, a number of soil borings should be drilled in areas of the west calcine to characterize subsurface conditions and to confirm the assumptions of calcine on soil to support RI conclusions. In particular, areas where calcine rests directly on or near bedrock should be identified. A lysimeter should be installed at the bedrock interface. Collection of soil pore water within the calcine would allow for assessment that would be representative of leachate characteristics. Results would be interpreted

and assessed for potential contribution to ground water, and assessed for the identification of remedial technologies.

7.3 Recommendations for Additional Wells

The siting and installation of the wells described below will be specified in an approved work plan. The MST will develop the work plan, which will be reviewed by EPA and IDEQ, and approved by EPA, prior to siting and installing any new wells. The following well locations are recommended, based on an evaluation of the monitoring well network and the current remedy. Proposed well locations and rationale for placement include:

- A shallow well sited immediately west of the S-X processing portion of the former vanadium plant to address potential impacts to ground water;
- A new shallow well southeast of KM-17 to assess gradients and potential off-site pathways; and
- A fully-penetrating deep well sited at a location downgradient of the former Tronox facility within a defined area of most heavily impacted shallow ground water.

The proposed well sited west of the S-X processing circuit of the former vanadium plant will assess potential contributions from the former plant process facility and provide additional data to assess concentrations and trends for wells downgradient (wells KM-5, KM-6, KM-7) from the partially covered plant foundation footprint.

The proposed well that would be sited south of the covered scrubber pond and calcine cap and south to southeast of off-site well KM-17 would be utilized to evaluate water levels, aquifer properties, water quality concentrations and address the extent of COC in ground water that currently exceeds the RBC. Data obtained from this well would be used in conjunction with the other off-site wells KM-15, KM-16 and KM-17 to gain a comprehensive understanding of off-site flow paths to the south of the most heavily impacted ground water areas.

The current understanding of the shallow and deeper wells on the industrial site is that little difference exists between piezometric heads, and that the concentrations of COC decrease vertically in the aquifer near the source areas. The intermediate depth wells KM-10, KM-11, KM-12 and deep well KM-19 have smaller concentrations than their respective nearby shallow wells. However, off-site wells KM-15 (shallow-depth) and KM-18 (intermediate-depth) located southwest of the site and to the west of the Finch Spring fault show vertically downward gradients between the two wells with similar concentrations of COC in both wells exceeding the RBC. The downward gradient is assumed to be induced by the fully-penetrating Monsanto production wells, where a vertically downward gradient is inferred within the capture zone (Golder, 2007).

Data from wells KM-15 and KM-18 indicate their piezometric heads are influenced by drawdown induced by the Monsanto production wells. Water quality data at off-site wells KM-15 and KM-18 indicate that COC are mixing vertically and currently exceed the RBC in the shallow and intermediate depth basalt aquifer at this location based on water level observations and water quality trends. The degree to which this mixed ground water is captured by the Monsanto production wells is unknown. Some of the mixed deeper ground water may follow regional ground water flow gradients, assumed to be to the south from this area. No deeper well data is available to the south of Monsanto well TW-11 on the southeast corner of the Monsanto site. Therefore, in order to assess deep water quality and potential pathways and exposures off of the former Tronox site, a deep well should be sited on the City of Soda Springs property, preferably downgradient of the Monsanto well capture zone. Ideally, a deep well would accompany a shallow well to assess vertical gradients and be sited within the most contaminated shallow ground water. This location would ideally be placed no further south than the Evergreen facility.

7.4 O&M Plan and Corrective Actions

It is recommended that a consolidated and revised O&M plan that describes the work to be done be prepared, reviewed and approved prior to implementation. The consolidated

and revised O&M plan would be submitted to USEPA for approval before being implemented, as required by Paragraph 11.f. of the Remedial Design/Remedial Action Consent Decree for the Site. The O&M plan should be developed and implemented to address the short-term issues identified during the remedy evaluation inspection, and long-term maintenance of the current site remedies as a whole. The consolidated O&M plan would address and update the landfill or calcine cap O&M plans at this time. The plan should outline the steps that will continue to be taken to eradicate the deep tap-rooted plants inside the fenced areas of the on-site landfill and calcine cap, and address filling in holes caused by animal burrowing or digging. The plan should also address areas of cover erosion and fence maintenance.

In order to address the potential problems that were identified during the 2008 field inspection, it is recommended that the consolidated O&M plan be revised to a site-wide O&M plan. This plan would be prepared following the approval of the final remedy evaluation report. The revised site-wide O&M plan should be updated to address site grading, runoff, establishment and maintenance of vegetation, or cover maintenance for the scrubber ponds, limestone settling ponds, west calcine, map ponds, plant and areas surrounding areas and establishment and maintenance of snow fences to reduce snow drifting on the site. The work addressed by this plan should address grading at the various sites as required to remove the low-lying areas, erosion rills and other physical problems that were identified during the site inspection. The work in this plan would include reseeding the disturbed areas and areas indicating a lack of vegetation. This plan would also contain the activities that will be taken to determine the depth of any existing burrows, the steps taken to fill in the animal burrows and any eradication of the animals making these burrows. Following the completion of the data evaluation of the proposed investigations, the consolidated and revised O&M plan should be updated as necessary to reflect any required changes to the remedy that result from the findings of the investigations.